SECOND GEOLOGICAL SURVEY OF PENNSYLVANIA.

To his Excellency JOHN F. HARTRANFT, Governor of Pennsylvania, President of the Board of Commissioners of the Second Geological Survey of Pennsylvania:

1008 CLINTON STREET, PHILADELPHIA,
DECEMBER 31, 1874.

SIR:—I have the honor to present the following Report of the progress of the Survey in its first year, 1874.

The Act of Legislature ordering the Survey, was passed May 14th, 1874.

The Board of Commissioners met for organization at Harrisburg, June 5th, 1874, at which meeting a Director of the Survey was chosen, and a general knowledge of the required work was obtained.

At the second meeting of the Board at Harrisburg, June 26th, 1874, the rules and regulations of the Board were adopted, salaries were fixed, appointments of assistants confirmed, the plan of the Director of the Survey approved, and appropriations made to meet the expenses of the ensuing quarter.

The plan of survey proposed and adopted after careful discussion and modification to suit the limited means placed by the Act of Legislature at the service of the Board, involved: 1. The occupation of five specially important and hitherto little studied districts of the State, requiring immediate attention. 2. The postponement for the present of work in the best known anthracite and bituminous coal regions. 3. The postponement for the present of systematic study of fossil forms, on a large scale. 4. The establishment of a special laboratory at Harrisburg for the analysis of irons, steels, iron ores and other blast-furnace stock. 5. A special report, chiefly economical, on petroleum. 6. A special report on the mineralogy of the State, as at present known. 7. The publication of the season's work early in the winter and spring, in a series of separate, portable and cheap volumes, so as to make them practically useful to the

largest number of persons, each volume containing the illustrations of its own text, in the shape of maps and wood cuts, and printed from stereotype plates for future use ; and finally, 8. The exhibition of type specimens of the collections of the survey in a cabinet in the rooms of the Board, at Harrisburg.

From among about one hundred and twenty applicants for service in the survey the following gentlemen were chosen to take charge of the five districts in which only the Board felt authorized to commence work at first, in view of the fact, that after the purchase of all the instruments required and the equipments of the Iron and Steel Laboratory and Cabinet Rooms at Harrisburg, there would remain of the first annual appropriation of $35,000, say $30,000 for the actual business of the survey.

Mr. Andrew S. McCreath, of Baldwin, assistant in charge of the Iron and Steel Laboratory, at Harrisburg.

Prof. Frederick Prime, Jr., of Easton, assistant in charge of the Lehigh district.

Prof. Persifor Frazer, Jr., of Philadelphia, assistant in charge of the York and Adams district.

Mr. John H. Dewees, of Shamoken, assistant in charge of the Juniata district, for the special study of the Fossil Ore belts.

Mr. Franklin Platt, of Philadelphia, assistant in charge of the Clearfield and Jefferson bituminous coal district.

Mr. John F. Carll, of Pleasantville, assistant in charge of the Venango oil district.

Dr. F. A. Genth, of the University of Pennsylvania, Chemist and Mineralogist.

Mr. Henry E. Wrigley, of Titusville, to report on the petroleum of Western Pennsylvania.

Mr. Edward B. Harden, of Philadelphia, Draughtsman.

These gentlemen commenced work at various dates in the months of July and August, and have been actively employed to the present time. The exceptionally genial and open autumn weather of 1874 has permitted field-work to be prosecuted into December, and Mr. Dewees is still in the field.

The field parties were made up by the appointment of the following named gentlemen, all of them experienced Assistant Civil Engineers, trained on the various railroad lines of our

State to the use of instruments, and good draughtsmen accustomed to reduce their field-notes to the form of the required maps, profiles, cross sections, vertical sections, &c., and of their skill and diligence I cannot speak in terms too high:

Mr. Ellis Clark, of Ambler, Pa., assistant to Prof. Prime; Lehigh district.

Mr. Ambrose E. Lehman, of Lebanon, Pa., assistant to Prof. Frazer; York and Adams district.

Mr. Charles E. Billin, of Philadelphia, assistant to Mr. Dewees; Juniata district.

Mr. Richard H. Sanders, of Philadelphia, assistant to Mr. Platt; Clearfield and Jefferson district.

Mr. F. A. Hatch, of Johnstown, Pa., assistant to Mr. Carll; Venango and Armstrong district.

Mr. Frederick Watts Foreman, of Harrisburg, was appointed assistant to Mr. McCreath in the Laboratory at Harrisburg.

To render the various parties efficient, the following gentlemen were appointed additional aids, or served as volunteers, throughout the season:

Mr. Joseph R. Shimer, of Lafayette College, Easton, with Prof. Prime.

Mr. Charles H. Allen, of Harrisburg, aid to Prof. Frazer, and now in the Museum at Harrisburg.

Mr. J. W. Edwards, volunteer aid to Prof. Frazer, and afterwards in the Lehigh district.

Mr. C. A. Ashburner, of the University of Pennsylvania, aid to Mr. Dewees.

Mr. G. H. Christian, Jr., of the University of Pennsylvania, aid to Mr. Dewees.

Mr. Arthur Hale, of Williams College, Mass., volunteer aid to Mr. Dewees.

Mr. H. J. Fagen, of the University of Pennsylvania, aid to Mr. Platt.

Mr. C. A. Young, of the University of Pennsylvania, aid to Mr. Platt.

Mr. Henry M. Chance, of the University of Pennsylvania, volunteer assistant for making special surveys of the Delaware and Schuylkill Water Gaps.

The equipment of each field party consisted of the following

instruments, manufactured by Heller & Brightley of Philadelphia, viz: one transit with vertical circle and cross hairs, for stadia measurement of distances, with telemeter rod; one surveyors' compass, with ball and socket on light tripod; one odometer, with ten foot wheel, copper tyre and Jacob staff, to which the compass was transferable; two hand (Locke) levels; two clinometers; steel chain, table instruments, note books, &c.

As reliable aneroid barometers of sufficient delicacy could neither be manufactured in this country nor imported from Europe by the ordinary channels of trade, and as the use of such instruments is indispensable for doing the best modern geological work, I visited myself, by permission of the Board, the factories of instruments of precision in Europe, sailing from Philadelphia the 13th of July, and returning to Philadelphia the 2d of September; having organized the field parties and seen them at work before my departure.

During the twenty-four days which I spent in Europe, I visited instrument makers in Rotterdam, Brussels, Neufchatel, Zurich, Paris, and London. My conviction is that no aneroid barometer of the ordinary well-known patterns to be found in the shops can be considered a useful instrument in the special work of those field geologists who insist upon obtaining the very best possible practical results. I have used most of these forms, and have found them obnoxious to the following objections: 1. Their scale is so minute that the eyes are strained to read less than 40 or 50 foot variations of height; 2. Their action is irregular, owing to imperfect workmanship in the capsules and gearing, and especially to a back-lash in the joints; 3. Their asserted "compensation" for varying temperature is a delusion. One of the most carefully constructed London aneroids of high price, and marked "compensated," was recently sent to me for acceptance as a perfect instrument; but on repeated trials with a temperature-range between 35° and 95° F., it alternately lost and gained 125 feet of height-reading.

Twenty years ago I devised a form of aneroid to overcome these difficulties, and was fortunate enough to find in the distinguished balance-maker of Europe, Mr. Becker, one who could make it for me. To his consummate mechanical genius and perfect workmanship I owe an instrument which, after

years of practical experience with it on many surveys, I can pronounce nearly perfect, as a geologist's aneroid. It has twelve vacuum-boxes, mounted in two piles of six each, the piles surrounded by a compensation yoke, and the index driven by a T rachet. The dial plate gives a circuit of 14 inches. The index travels 7 inches for one of the mercurial column, and can be adjusted to travel 7 inches for 1,000 feet of elevation within any section of the mercurical range. A set screw, placed beneath, carries back the index; so that the 2,000 foot circuit may be repeated eight times, if mountains are to be ascended not exceeding a height of 16,000 feet. My object was, however, to obtain a large visible motion of the index in a country like Pennsylvania, where the range from sea-level to the highest mountain summits does not exceed 3,500 feet. Heights of $2\frac{1}{2}$ feet can be easily read at a glance. The compensation for thermometer is very good, and the instrument is very light. Ordinary aneroid barometers may satisfy explorers and travelers, who wish to record considerable variations of altitude by observations at considerable intervals of time. But an accurate field-geologist must read his aneroid *at every station*, *every few minutes*, and must distinguish variations of altitude amounting to only a few feet. The accuracy of his geological deductions will always depend on the truthfulness of his topographical delineations, and this again will depend on the number and reliability of his aneroid observations.

The best makers in Europe told me candidly that they were unable to reproduce Mr. Becker's aneroid. Elliott and Bros., Charing Cross, London, took drawings and measurements of its interior, and promised to send me a *fac-simile* for trial. But the difficulties were no doubt too great for their best workmen, for no such instrument has as yet been forwarded to my address. Mr. Becker made five of these instruments, two of which I own. A third was sent to the late Chief Engineer of the Grand Duchy of Baden, M. Eisenlohr, who reported enthusiastically upon its behavior at the Swiss Congress in Geneva in 1858 (?). A fourth was possessed by Mr. Thomas Blackwell, Managing Director of the Grand Trunk Railroad, until his death. The fifth was carried by a German traveler across South America, and has also disappeared. I have a hope that Mr. Becker may

consent to manufacture more of these instruments for the use of the survey; but he has thus far refused, because, owing to the dearth of skilled workmen not fully employed in other equally difficult tasks, he will be obliged to undergo the labor himself, at an age when he richly deserves to be left untroubled, to the enjoyment of his rare fame as a mechanician of the highest order. These personal details may seem out of place, or in bad taste, in a report like this. But I feel sure that my fellow geologists, and all accomplished and ambitious civil engineers will be gratified to learn the history of an attempt to place at the disposal of their craft a piece of apparatus for which there has been persistent, growing and impatient inquiry.

Feeling that *some* good form of aneroid must be obtained for the survey, I ordered a dozen from M. Goldschmidt of Zurich, after testing specimens in his shop. This instrument is coming into use among civil engineers. It is a cylinder about 4 inches high, on the top surface of which are described several concentric scales, traversed by an index, moved by a button. By turning this button (and the index with it) the observer, looking through an attached microscope into the interior of the box, brings a needle point to a datum line. An observed number on a small scale (visible in the field of the microscope) informs him, then, by which one of the several scales on the lid of the box he is to read (with the large index attached to the button) *the height of his station of observation above tide, in metres.* Adjustments to half a metre are easily made through the microscope.

I am sorry to say that several months have passed and the Goldschmidt instruments, then ordered, have not yet arrived.

For want of aneroid barometers the work of the survey has been greatly retarded. I feel sure that if two reliable aneroids could have been given to each field party, at least twice as much ground would have been gone over, and twice as large a report would now be in process of publication. A few of the shop aneroids were tried, and soon laid aside as useless, by the gentlemen in charge of the different districts, and were only used in exceptional parts of their work.

The method of survey pursued by all the field parties was essentially the same; although the widely different characters

of the districts occupied caused great differences in the areas gone over, and in the results obtained; as will appear by the published reports, and need not be specified here.

The method of survey adopted was as simple as a long experience of field work dictated to be possible.

Base lines in each district were run and leveled along selected main roads and the topography carefully studied; plotting and contouring being done in the note-book in the field. From these note-book plottings the maps have been made, both by replottings and by transfer.

The note-books of the survey are all alike, one page being cross-barred for plotting; blue lines an inch apart; red lines $\frac{1}{4}$ inch apart. The top of the page is always taken as north. The last station before a line runs off one page is carefully located in the same relative position within some square inch on the next page. Consequently transfer of plotted lines from note-book to sheet plotting paper is easy and continuous. The opposite plain-ruled page holds the notes and sketches. Each book is numbered, and has an index of lines run written on its front cover, and a sketch-map of connected lines on its back cover. All stations in one district are numbered continuously from 0 to 10,000, to prevent any two stations from having the same number. Stations numbered in red; level numbers and contour-lines in blue; houses, fences, &c., in black. A permanent original record of all the work done during the survey will thus be preserved in a shape convenient for reference. Economy in note-books is disastrous to any survey.

A universal scale was adopted, for the whole survey, of 400 feet to the inch in the original plottings, and 1600 feet to the inch in the reductions. Local maps and sections will be published thus reduced to a scale of 1600. District maps will be still further reduced by the camera to 3200 or some still smaller scale. The necessity for a rigid adherence to a common scale will be appreciated by the geologists of the survey when they come to compare their own numerous sections together, and those of each other, along the same belts of rock. It will make the publications much more useful to experts and the public, for whose benefit the survey is intended.

While the aids carried on the instrumental work, the assistant

in charge of the district studied its geology, made reconnoissances in advance, visited all the mines and important exposures, and determined the direction in which the field work of his party should move forward, and the amount of such work which was necessary or possible. Lines of outcrop were traced and specimens collected and forwarded to headquarters for analysis. Transfers of the plottings to sheets were made in bad weather, or in the evenings, and forwarded to Philadelphia for reduction in the office. Railway surveys were obtained by Mr. Harden, copied on the survey scale, and sent to the parties in the field for their use. He also provided all materials required by the field parties, and kept records and accounts of all that was done and expended. To his indefatigable diligence, attention and ability is largely due the smooth working of so complicated a machine as a State survey necessarily is.

Citizens of the Commonwealth have exhibited much interest in the operations of the parties in the field, and furnished information of great value. Unpublished reports and records of mines, borings, minerals and fossils have been freely tendered for publication. A great deal of the private geological work of recent years is at our command, and will come of use.

Such materials for knowledge are sure to be evoked by a State survey; and an important part of the business of the gentlemen in charge of districts has been to secure, examine and improve these materials for their reports.

But the main intention of the Second Geological Survey of Pennsylvania goes much beyond the collection of scattered items of unpublished information. The records of the First Geological Survey afford a thousand times more real information about the geology of the State than can be thus gathered up. The accuracy of most of the statements made by the geologists whose reports are condensed and consolidated in the final report of Prof. H. D. Rogers, published in 1858, is a matter of constant remark and admiration with the assistants now in the field. Yet the first survey was essentially a reconnoissance. Those engaged in it thirty years ago worked chiefly without instruments of precision and under the greatest inconvenience. Their views were broad, their isolated observations numerous and exact, but their districts never were *accurately surveyed* by them,

nor could be. The second survey is intended to supply this lack; to take up their work where they left off; to reduce their general statements to precision; to measure, where they could only estimate; to define, what they could only indicate; to demonstrate, what they could see to be true, but which they could not prove and show in all its truth. Geological field work now and geological field work forty years ago differ as widely as the present methods of surveying an anthracite coal property differ from one of our old-fashioned land warrant surveys. And I trust that the reports of 1874, now in press, will make both the manner and the necessity of this difference so manifest to everybody, that none will be disposed to cavil at the quantity of work accomplished, or the scrupulous attention which has been expended upon its details.

The following reports are either already in the printer's hands, or nearly ready for publication:

A. My Report to the Board of Commissioners on the work of 1874, followed by a history of Geological Exploration in Pennsylvania from the beginning.

The object of this statement is to show what a Geological State Survey really means; what is its public necessity; the nature of the problems it solves; how it works; what are the difficulties it encounters; and its methods of overcoming them; its necessarily slow and laborious progress; the imperfection of its results; the immense accumulation of facts; its power to stimulate the intellect of the State; to sweep away costly superstitions respecting the mineral resources of the Commonwealth; and to increase the physical powers of society; what discoveries have been made since 1835, and what questions of geological importance remain unanswered.

This statement might be made in a more didactic form. But when sketched as a history, it gains in power over the imagination more than it loses in systematic arrangement. In the course of forty years every point of geological science has been in turn, and many times, touched by the geologists of Pennsylvania; and citizens of the Commonwealth ought to have exhibited to them the manly struggle of these past forty years—a contest between our youthful, growing, strengthening and

maturing science and the powers of darkness of the Underworld, the stubborn instinct for concealment in Nature, and the prejudices and falsifications of half-educated men. If this strife be well painted, the future consequences of a victory of light over darkness, of science over ignorance, in relation to the Geology of our State, will be made clear to every one. There will be no longer need to plead or apologize for a State Geological Survey.

B. A Report on the Mineralogy of Pennsylvania, by Dr. F. A. Genth.

A map of the Cornwall Iron Mine will accompany this report.

Dr. Genth gives the character of every kind of mineral known to be found in Pennsylvania, with references to their geographical situations, and to the public and private museums in which specimens of them may be studied. This little volume of about 150 pages will be a valuable text book for the Public Schools, as well as a guide for the assistants on the survey.

C. A Report of Progress in York and Adams Counties, by Prof. Persifor Frazer, Jr.

A map of the district, by Mr. Lehman, and—

Three profile sections through York, Hanover and Gettysburg, will illustrate this report. The map shows all the lines run and leveled to connect the ore banks, which are seen to lie in belts.

A small map and section of the Dillsburg Ore Mine, by Mr. Platt, is appended, because it exbibits a discovery of the utmost importance for the proper understanding of the structure of this part of the State.

A map of the mountain region north of the Gettysburg and Chambersburg Pike, made by Mr. Platt in 1873, is added for a similar reason.

D. A Report of Progress in Lehigh County, by Prof. Frederick Prime, Jr.

A map of the district between Albertis and Allentown, elaborately contoured by Mr. Clarke, exhibits the arrangement of about a hundred iron ore mines in three belts.

A map of the Schuylkill Water Gap, by Mr. Chance, and—

A map of the Delaware Water Gap, by Mr. Chance, are appended to Prof. Prime's report, as being in his district, and for the purpose of showing the geological relationships of the roofing slate formation to the North Mountain rocks. They are models of topographical work. The season was too short to permit the survey of the Lehigh Water Gap, with its slate quarries, which will be done in the ensuing year.

E. A Report of Progress in the Siluro-Cambrian Limestone Valleys of Middle Pennsylvania, by Mr. Franklin Platt.

A map of the Brown Hematite Ore Banks on the Warrior Mark and Spruce Creeks, made for Lyon, Shorb and Co., by Mr. Platt in 1873, is appended to this report, and included in the same volume with Prof. Prime's report, so as to have as many facts under the eye at once as are known to illustrate this important and difficult part of our geology.

A section across Nittany Mountain and through the Bellefonte Gap, by Messrs. Young and Fagen, is added for comparison with the three sections (of 1873) between Tyrone and Warrior's Mark; to show how the Bald Eagle Mountain Fault ends before it reaches Bellefonte; and to indicate the character of the Nittany and Brush Valleys, to be surveyed during the ensuing year.

F. A Report of Progress in the Juniata District, by Mr. John H. Dewees.

A map of the southern flank of Jack's Mountain from Logan Gap to Jack's Narrows, elaborately contoured by Mr. Billin, and—

Five profile sections drawn by Mr. Ashburner, illustrate this Report, which not only relates the outcrops and mine openings of the fossil ore of the mountain, and the brown hematite bed of McVeytown, but minutely defines the Silurian and Devonian formations from the Trenton up to the Hamilton. The recent exploration of the fossil ore for ten miles west of Mt. Union and ten miles east of Lewistown will be described. The map of the mountain is intended to show how all the mountain

region of Pennsylvania *might be* and *ought to be* surveyed, and published for the benefit of the community, if the Legislature should provide the necessary funds for such a work.

G. No work has been done in the anthracite region; but a section of the coal beds traversed by the deep shaft and boring at East Norwegian, near Pottsville, will be republished from the report of the President of the Reading Railroad for 1875; because its importance for the geology of the coal measures can hardly be over-estimated, as it completely confirms the accuracy of the knowledge obtained by the First Geological Survey in 1837–1840, while it throws new light on the precise shape of the sharp folds into which the coal beds have been complicated at the bottom of each synclinal trough.

H. A Report of Progress in the Bituminous Coal Region of Clearfield and Jefferson counties, by Mr. Franklin Platt.

A map of the Osceola region;

A map of the Snowshoe basin;

A map of the Clearfield basin; and—

A map of the Reynoldsville basin, in contours; with—

Local vertical sections, about a hundred in number, of individual coal beds, and columns of coal measures; all drawn by Mr. Sanders;

A map of the Red Bank cannel coal field; and—

A map of the bituminous coal adjoining; by Mr. Blandy, and presented to the survey by Mr. John Wilson, will illustrate this report.

A report of a recent survey of the Johnstown coal field in Cambria county; and—

A map of the same; by Mr. John Fulton, of Saxton, Blair county, will be published, by permission, in the same volume.

A section of the sub-carboniferous rocks of the Allegheny Mountain, underlying Mr. Platt's district, by Messrs. Young and Fagen will accompany Mr. Platt's report.

A section of the Bishop's Summit coal measures in McKean county, by Mr. Graham McFarland, with a map of the neighborhood, has been promised for this volume.

I. A Report of Progress in the Venango Oil Region, by Mr. John F. Carll, of Pleasantville.

A map of lines run and well-mouths leveled between Oil Creek and the Allegheny River; with—

Sections in two directions across the district, showing the number and slope of the oil-bearing and mountain-sand rocks;

A vertical column of rocks below the coal measures, showing the horizons of fossils, &c., and—

A general map of the country, by Mr. Carll and Mr. Hatch, will illustrate this report.

A Report of his observations around Warren has been kindly volunteered by Mr. F. A. Randall, of Warren.

A report on the Brady's Bend coals and oil, with local maps and sections, made in 1865, will be in part republished to show the relationships of the oil to the coal.

Records of oil-wells of various dates will be given in this volume of Mr. Carll's Report.

J. A Special Report on Petroleum, by Mr. Henry E. Wrigley, of Titusville, Venango county.

A small map of the Oil Regions of the Middle States and Canada;

A large map of the West Pennsylvania and West Virginia Oil Regions, with lines of geographical limitation between gas wells, light-oil wells, and heavy-oil wells;

A profile section from Lake Erie to Butler, showing the general slope, under ground;

A chart, showing the construction of derricks, seed-bags, bull-wheels, boring-tools, &c.; and—

A chart, showing the relative life of wells and the number of live wells at the beginning of each year, illustrate this report, which sketches, in successive chapters, the history, boring, piping, and refining of petroleum, with special accounts of the principal wells.

A map and profile section from Clarion to Butler, carefully made by Mr. Lucas, C. E, and kindly presented to the Survey by Mr. Jos. D. Potts, of Philadelphia, will be published in the same volume; and a reduction of Mr. Lucas' section to the same vertical and horizontal scale will show how exceedingly

gentle is the southwestward slope of the whole oil country underground.

There was no good reason to expect from the survey, in the first four months of its progress, any discoveries of importance. Discoveries were the natural and perennial fruits of the First Survey, because nothing was really known about the geology of the State, and little about that of the United States. Every step made then was made on virgin ground; every observation had the charm of novelty; every mountain and valley was a separate riddle to be solved; every formation was strange to the eye, its contents unpredicted, its strata unclassified, their outcrops untraced. The region was as much a field for discovery as are the Territories of Colorado, Arizona, Utah and Nevada now.

All this is of the past. The light of thirty years has rested on the State, and revealed to geologists every feature of its structure. There seems nothing left for discovery. The business of the present survey is therefore critical examination, analysis, measurement, description and publication; the precise determination of qualities and quantities; the finer estimation of place, position, posture, mineral nature, metallurgical fitness, and mining facility; the verification of what has been the subject of the comparatively rough statements of past reports, and their authoritative re-statement in a more detailed way, more intelligibly, and with all the corrections and additions which the business transactions of many individuals and incorporated companies enable us to make.

In fact, however, questions of the highest importance have never yet been answered; in spite of the successful efforts of the first survey, and in spite of all the mining and exploring that has been done in the last thirty years. Every year reveals something unexpected. Discoveries are still possible; and to our astonishment some have been made in the four months of field operations just terminated.

Professor Prime seems to have found the key to the cause, and therefore to the nature, of the brown hematite deposits of the limestone valleys, by connecting them (instrumentally) with certain damourite (potash slate) beds which have hitherto been over-looked as of no importance to the case. The value of

this discovery will be tested in the course of the ensuing year. The question is one of prime interest to our iron manufacturers.

Mr. Platt seems to have hit upon a discovery of equal moment for a settlement of existing controveries respecting the cause of the universal northwest dip of the New Red formation, extending from Newhope through Bucks, Lancaster, York and Adams counties. The faults discovered by borings near Dillsburg, in York county, may explain the structure of a large part of southeastern Pennsylvania; and it certainly affects the mining value of a large range of iron ore deposits.

The discovery of a great fault at Port Clinton, on the Schuylkill, by Mr. Chance, is a marked event of the past season, and throws light on some perplexing portions of our geology.

The discovery of the extension of the outcrops of two coal beds already known to exist in *one* of the Allegheny Mountain ravines, near Altoona, for a long distance beyond the old openings, makes an important addition to our systematic geology; for these beds lie several hundred feet below the Conglomerate, and may be of workable thickness in neighborhoods where they are much wanted.

The probable identification of one of the "Mountain Sandrocks" of Venango county, by Mr. Carll, with the so-called "Conglomerate" of Olean and Chattauqua Lake, puts a new face on the geology of our northern and northwestern counties, and will have, if verified in 1875, an important influence on questions of underground measurement in that region.

These are sufficient to encourage the hope that the present survey of the State will not merely be successful in its proper work of gathering up and publishing a mass of useful discoveries made during the last twenty or thirty years, and never yet described and explained to the citizens of the Commonwealth, whose common property they ought to be, but may make new and equally important discoveries of its own. This can hardly fail to be the case, if the same care in observing all facts, and the same precise method of bringing them by careful instrumental measurements into their proper relations to each other, continue to govern the operations of the survey, which the re-

ports, published this winter, will show to have been the rule in the first field season, just closed.

It is a source of regret that several districts of the State have had to be entirely neglected for want of an appropriation equal to the original estimate of the working expenses of so large a survey. Four more working field parties might then have been employed.

The district of Greene and Washington counties, in the southwest corner of the State, needs a close instrumental survey, by which a map could be made, showing the depth of the Waynesburg and Pittsburg coal beds under every man's farm.

The district of Butler and Beaver counties needs a similar survey.

The district of Westmoreland, Indiana and Fayette is one of the richest in the State and should furnish, for publication, geological maps showing every important coal outcrop.

The district of Somerset and Cambria counties is very vaguely known.

The northern tier of counties are justly clamorous for attention, and well worthy of laborious examination. Other parts of the State also have a right to demand attention.

In conclusion, I beg leave to call the notice of the Board to a subject of importance, action upon which, however, may be beyond its duties or powers. It seems proper that a Geological Survey of Pennsylvania should be represented in the Centennial Celebration of 1876. The collections of the past four months have amounted to many hundred specimens of minerals and fossils. No doubt twice as large a collection will be made in the season of 1875. Those collected in 1874 are in process of arrangement for exhibition, so far as a very limited amount of space in the rooms of the Board, at Harrisburg, will permit. If an appropriation be made for a museum building at Harrisburg, it might be so worded as to include an order for the temporary exhibition of the collections of the survey in the Fairmount Park buildings, in 1876.

If a complete exhibition of the geology of the State is to be made on the Centennial Celebration grounds, a special appropriation is required for employing collectors whose entire time should be devoted to this object and to the arrangement of the

collection when made, and who might be under the direction of the Board of Commissioners of the Geological Survey; or, under some independent superintendence acting in cordial agreement with the Board. In the latter case, the work of the survey would suffer no hindrance, and yet would directly assist the performance of the duties devolved upon the Director of Collections for the Centennial. The means placed at the disposal of the survey are too limited to permit any of its corps of geologists to turn aside from their field work to attend especially to any such outside duty.

Among the most important objects to be kept in mind is the Exhibition of the Iron Industry of Pennsylvania, and some competent person ought to be appointed by Act of Legislature to take exclusive charge of this work; some one of high standing in metallurgical science, as well as of good executive capacity.

With these remarks respecting a subject of general interest to the community, and of very special interest to Geologists, I beg leave to present the above Report of Progress of the Second Geological Survey of Pennsylvania in 1874, and remain,

With great respect,

Your obedient servant,

PETER LESLEY